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Blackwood

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(54) **NAVIGATION DEVICE AND METHOD FOR DETERMINING NETWORK COVERAGE**

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(73) Assignee: **Tom Tom International B.V.**, Amsterdam (NL)

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(22) Filed: **Jan. 9, 2008**

(65) **Prior Publication Data**

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Related U.S. Application Data

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(51) **Int. Cl.**
G01C 21/30 (2006.01)

(52) **U.S. Cl.** ... **701/209**; 701/201; 701/208; 340/995.12; 340/995.14

(58) **Field of Classification Search** 701/118, 701/200, 201, 207, 208, 209; 342/357.01, 342/357.06, 357.09, 357.1; 340/988, 991, 340/995.1, 995.12, 995.13, 995.14
See application file for complete search history.

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2006/0041373 A1 * 2/2006 Rowe 701/200

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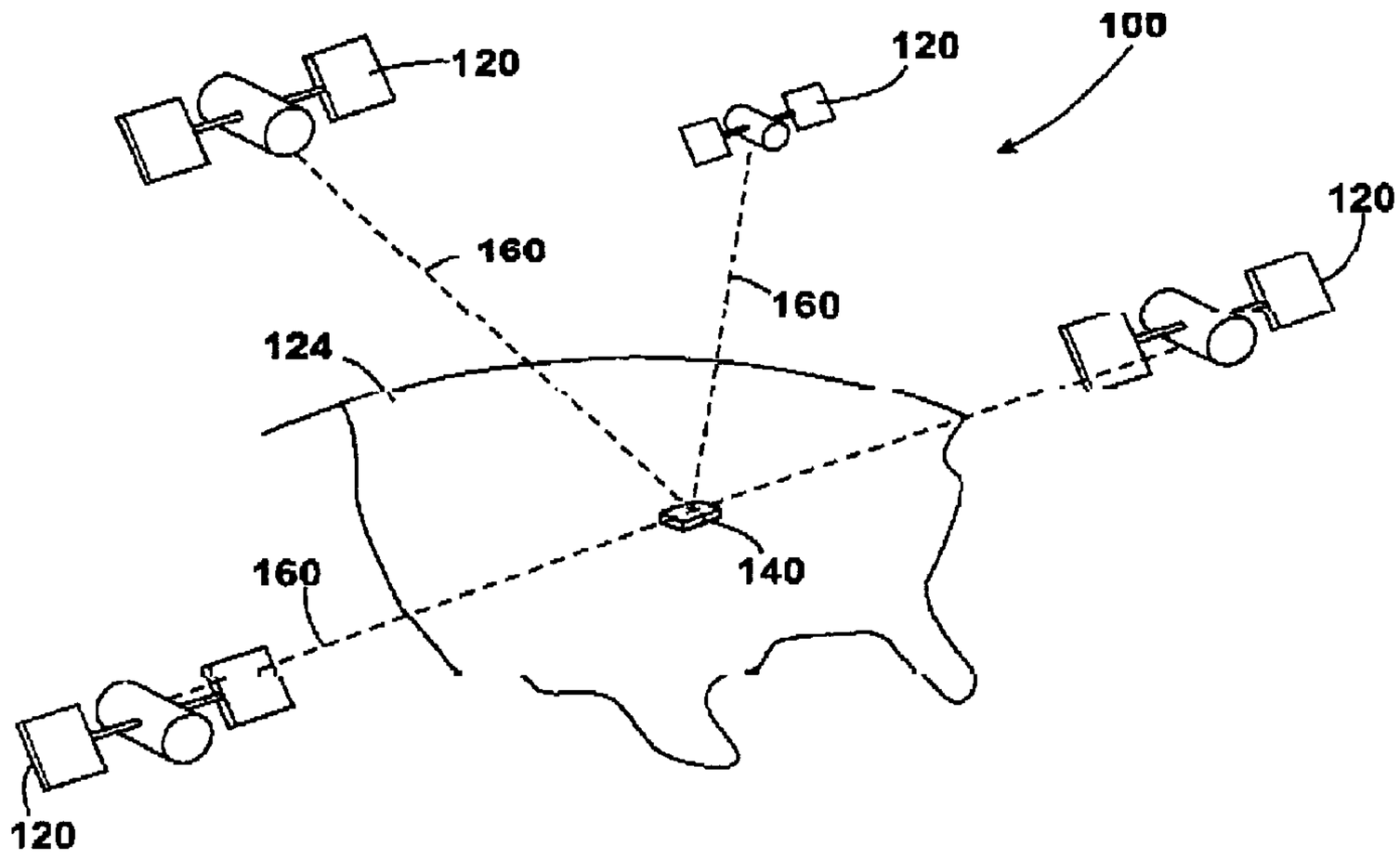
(57) **ABSTRACT**

A method and device are disclosed for navigation. In at least one embodiment, the method includes determining a route of travel of a vehicle in which the navigation device is located, based upon at least a desired destination and a current location of the vehicle; storing map information including attribute information relating to network area coverage; and determining, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel. In at least one embodiment, the navigation device includes a processor to determine a route of travel of a vehicle in which the navigation device is located, based upon at least a desired destination and a current location of the vehicle; and a memory to store map information including attribute information relating to network area coverage, the processor being further useable to determine, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel.

60 Claims, 8 Drawing Sheets



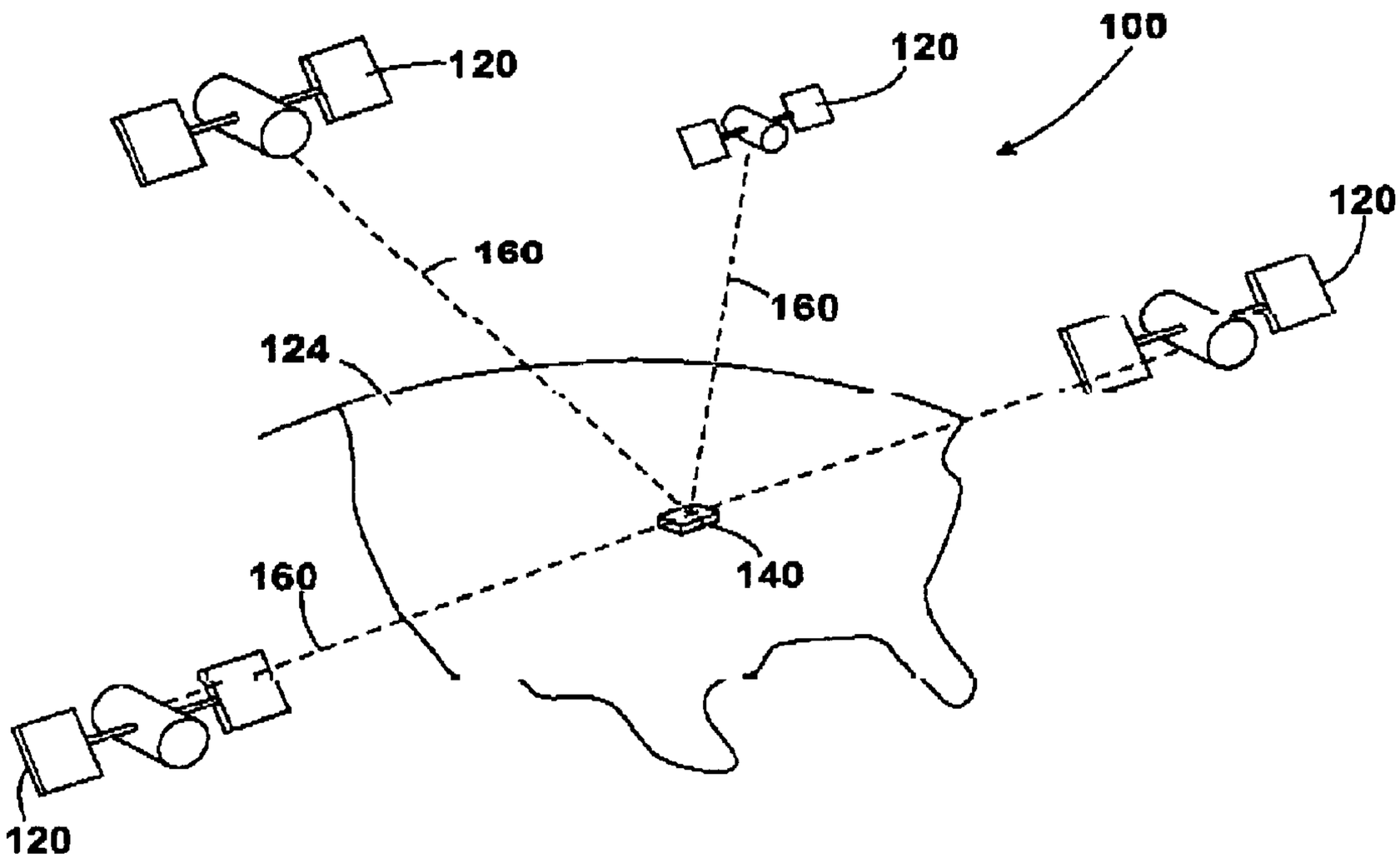


Fig. 1

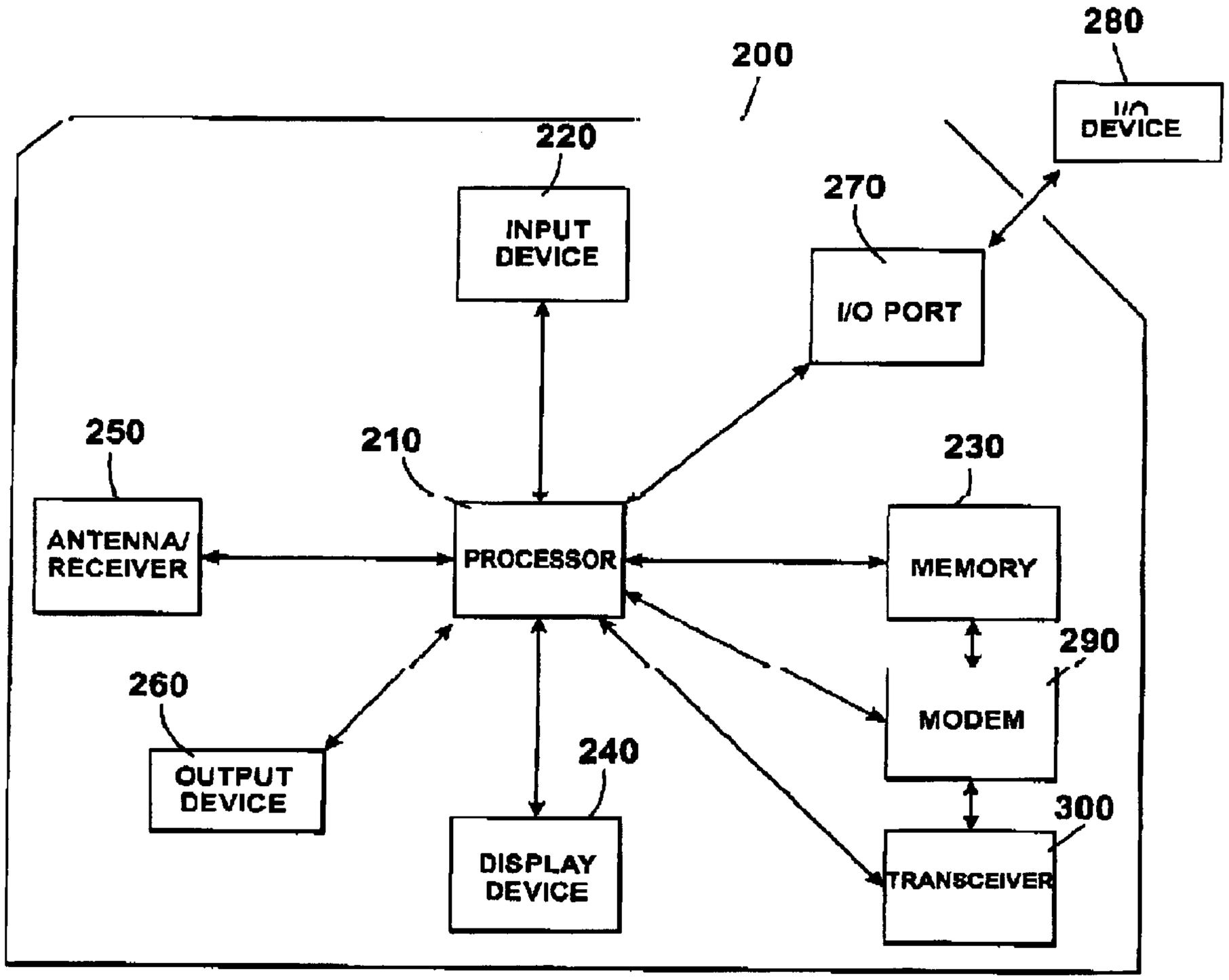

200
280
I/O DEVICE
220
INPUT DEVICE
270
I/O PORT
250
210
230
ANTENNA/ RECEIVER
PROCESSOR
MEMORY
290
260
MODEM
240
OUTPUT DEVICE
300
DISPLAY DEVICE
TRANSCEIVER

Fig. 2

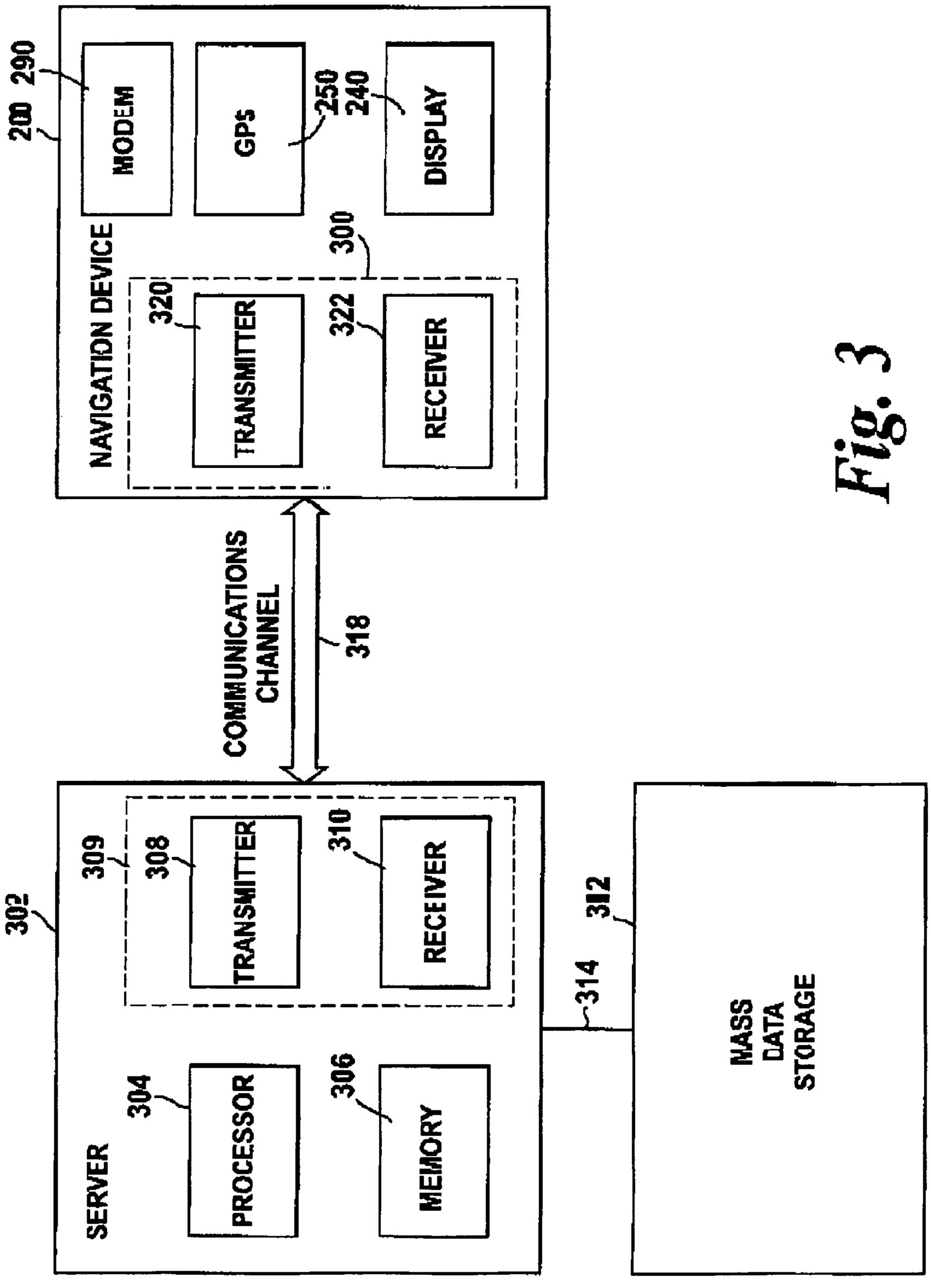

200
290
MODEM
GPS
250
240
DISPLAY
NAVIGATION DEVICE
300
320
TRANSMITTER
322
RECEIVER
COMMUNICATIONS CHANNEL
318
302
309
308
TRANSMITTER
310
316
RECEIVER
SERVER
304
PROCESSOR
306
MEMORY
314
312
MASS DATA STORAGE

Fig. 3

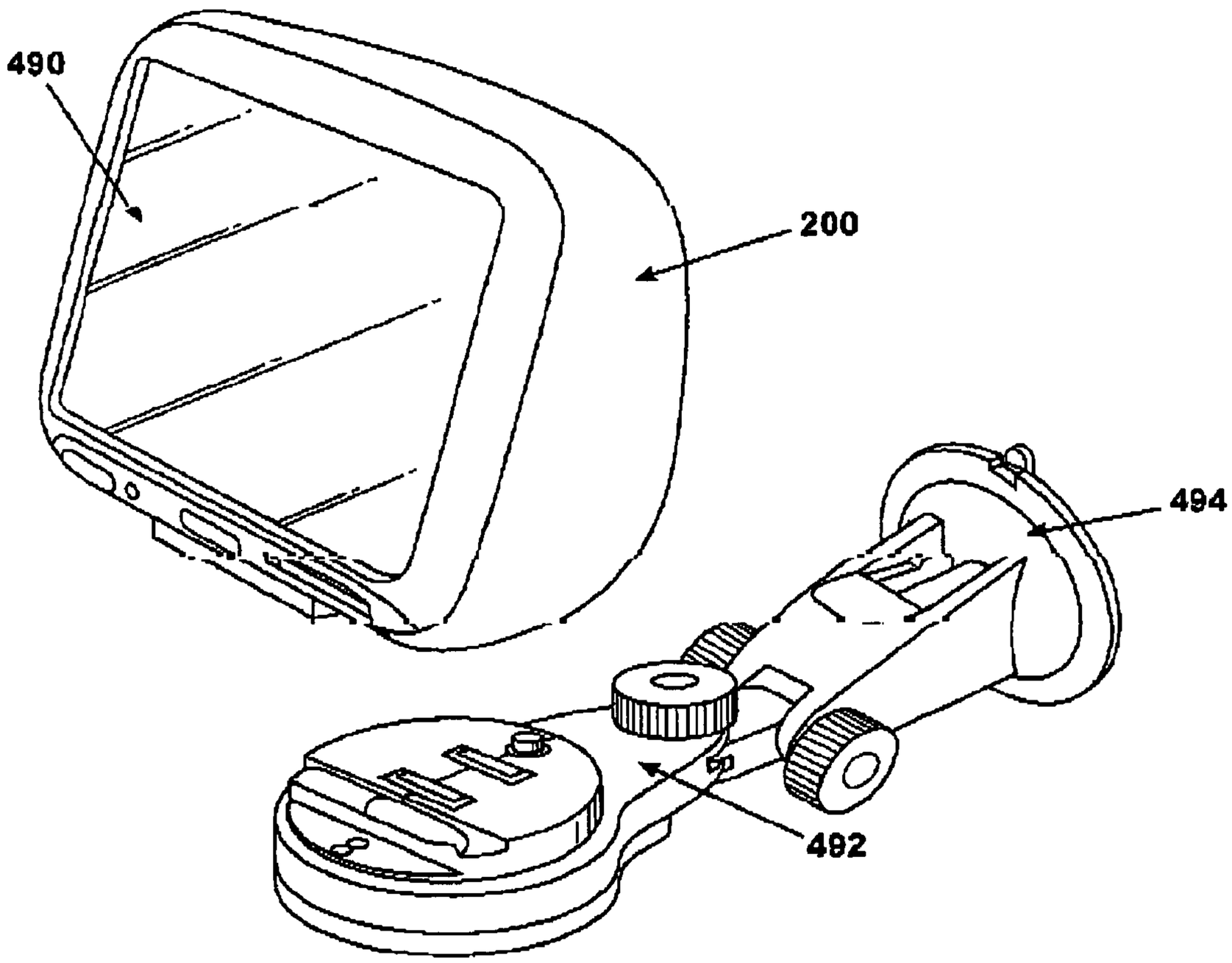


Fig. 4A

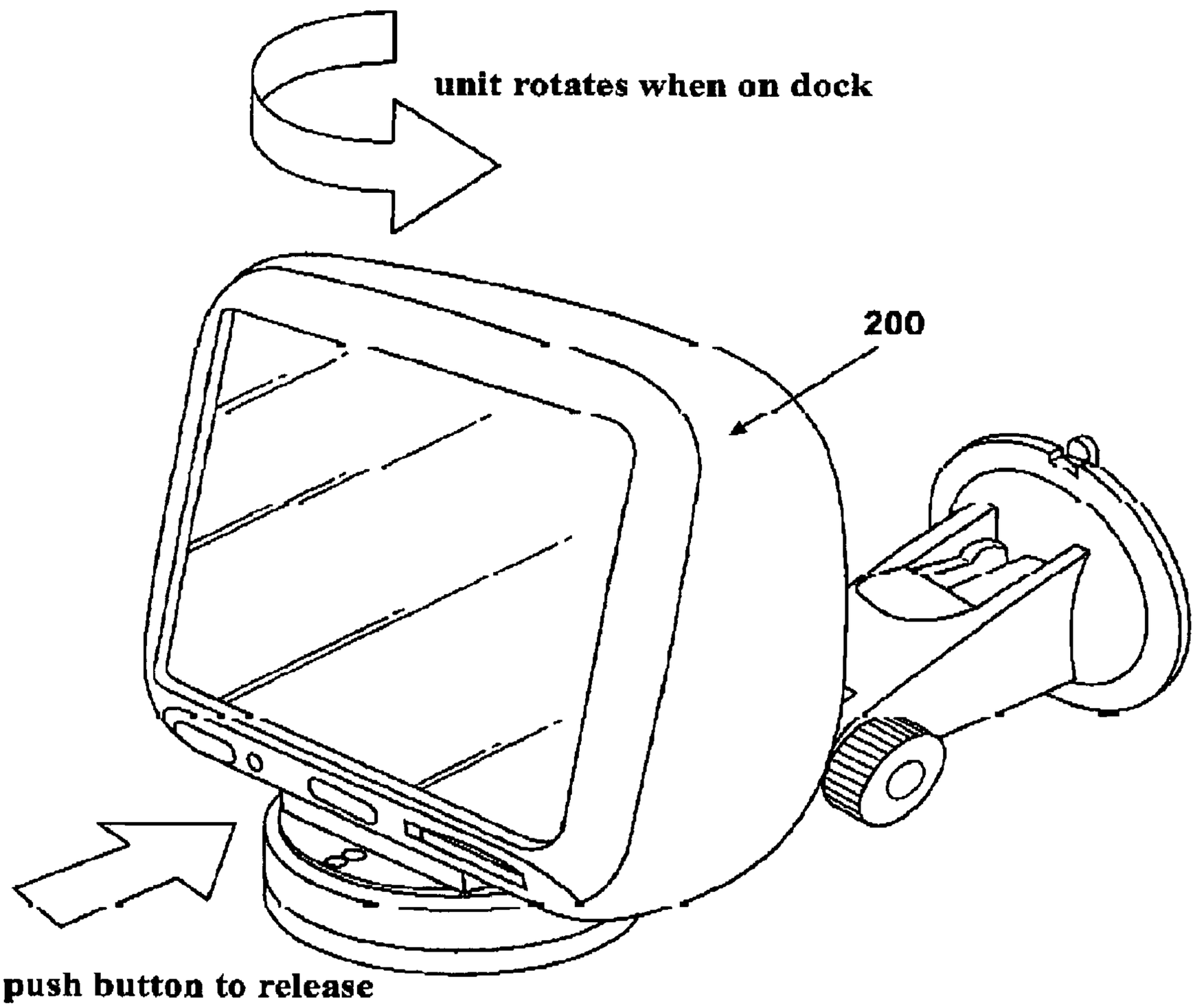


Fig. 4B

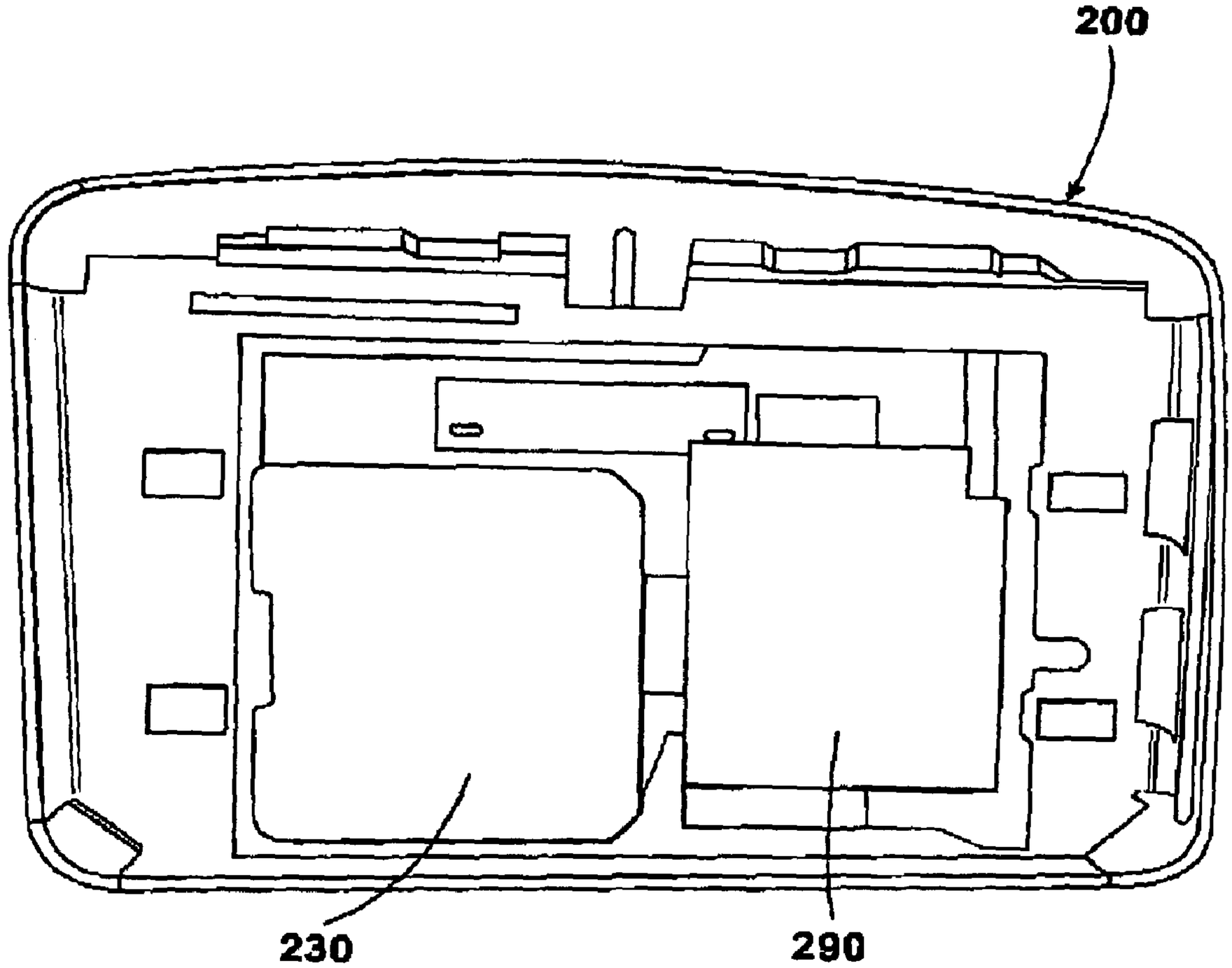


Fig. 5

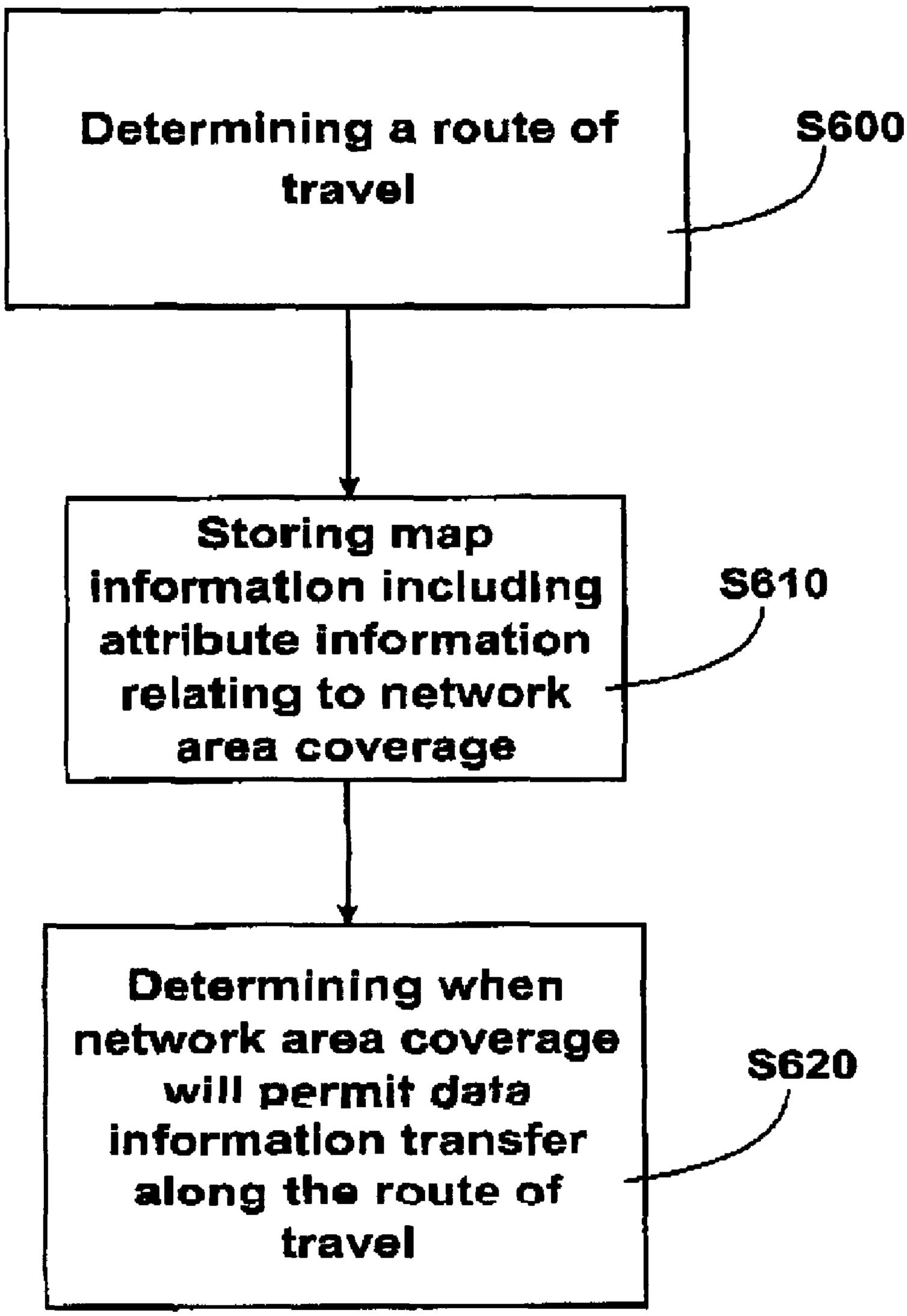

Determining a route of travel
S600
Storing map information including attribute information relating to network area coverage
S610
Determining when network area coverage will permit data information transfer along the route of travel
S620

Fig. 6

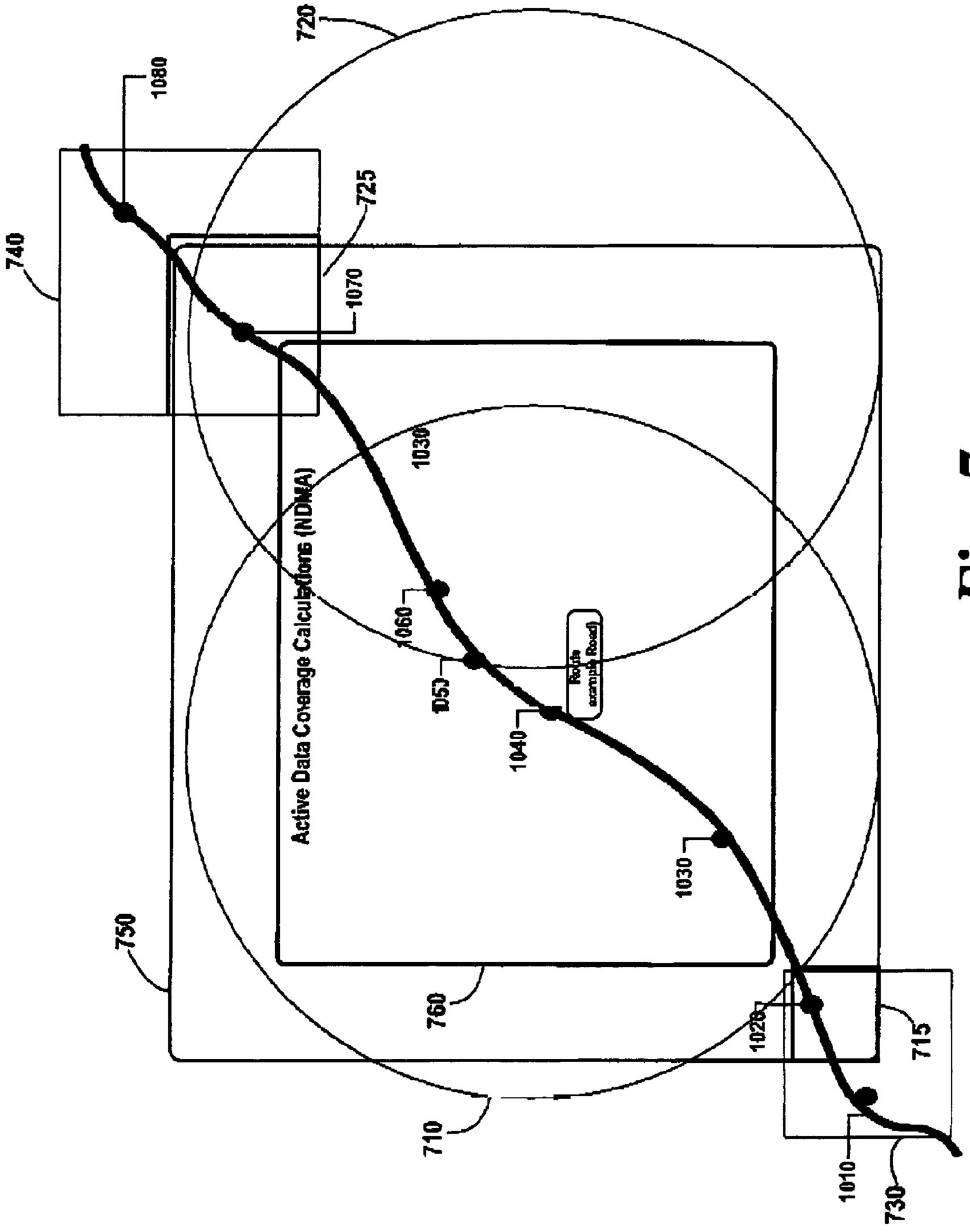

720
1080
725
740
1070
1030
Active Data Coverage Calculations (NDMA)
1060
1050
Route example Road
1040
1030
750
760
1020
715
710
1010
730

Fig. 7

NAVIGATION DEVICE AND METHOD FOR DETERMINING NETWORK COVERAGE

CO-PENDING APPLICATIONS

The following applications are being filed concurrently with the present applications. The entire contents of each of the following applications is hereby incorporated herein by reference:

A NAVIGATION DEVICE AND METHOD FOR ENHANCING TRAFFIC DATA filed on even date herewith; A NAVIGATION DEVICE AND METHOD FOR IMPROVING A TIME TO IDENTIFY A LOCATION OF THE NAVIGATION DEVICE filed on even date herewith; and A NAVIGATION DEVICE AND METHOD FOR PROVIDING ALTERNATIVE NETWORK CONNECTIONS filed on even date herewith.

PRIORITY STATEMENT

The present application hereby claims priority under 35 U.S.C. §119(e) on each of U.S. Provisional Patent Application Nos. 60/879,543 filed Jan. 10, 2007, 60/879,593 filed Jan. 10, 2007, 60/879,598 filed Jan. 10, 2007, and 60/879,541 filed Jan. 10, 2007, the entire contents of each of which is hereby incorporated herein by reference.

FIELD

The present application generally relates to navigation methods and devices.

BACKGROUND

Navigation devices were traditionally utilized, in vehicles or even on foot, for navigating between two points. Such devices, when used in vehicles, often initially tried to plan a fasted route based upon, for example, a route including mostly highway usage. Such a route was planned to maximize vehicle speed during travel along the route.

During such travel, however, a vehicle would often encounter traffic delays, which would slow travel along even a route including mostly highways. Accordingly, navigation devices became more sophisticated and were able to receive information and to utilize the information to plan navigation routes around the traffic delays. Other services also became available to the navigation devices, such as providing locations of traffic cameras, providing additional updates other than traffic delay information, etc. Such traffic and other information could be provided, via a Bluetooth or other data connection, via a mobile phone paired with the navigation device. However, by using such paired mobile phone connections, users of the navigation devices were subject to network drops, roaming and other charges of the mobile networks.

SUMMARY

The inventors discovered that if network coverage areas could be determined, then accurate and complete data transfers and connections could occur.

In at least one embodiment of the present application, a method includes determining a route of travel of a vehicle in which the navigation device is located, based upon at least a desired destination and a current location of the vehicle; storing map information including attribute information relating to network area coverage; and determining, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel.

In at least one embodiment of the present application, a navigation device includes a processor to determine a route of travel of a vehicle in which the navigation device is located, based upon at least a desired destination and a current location of the vehicle; and a memory to store map information including attribute information relating to network area coverage, the processor being further useable to determine, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel.

In at least one embodiment of the present application, a navigation device includes means for determining a route of travel of a vehicle in which the navigation device is located, based upon at least a desired destination and a current location of the vehicle; means for storing map information including attribute information relating to network area coverage; and means for determining, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel.

BRIEF DESCRIPTION OF THE DRAWINGS

The present application will be described in more detail below by using example embodiments, which will be explained with the aid of the drawings, in which:

FIG. **1** illustrates an example view of a Global Positioning System (GPS);

FIG. **2** illustrates an example block diagram of electronic components of a navigation device of an embodiment of the present application;

FIG. **3** illustrates an example block diagram of a server, navigation device and connection therebetween of an embodiment of the present application;

FIGS. **4**A and **4**B are perspective views of an actual implementation of an embodiment of the navigation device **200**;

FIG. **5** is an example embodiment illustrating the modem and SIM card of the navigation device;

FIG. **6** is a flowchart illustrating an embodiment of the present application; and

FIG. **7** is a diagram illustrating an embodiment of the present application

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present invention. As used herein, the singular forms "a", "an", and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "includes" and/or "including", when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

In describing example embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the disclosure of this patent specification is not intended to be limited to the specific terminology so

selected and it is to be understood that each specific element includes all technical equivalents that operate in a similar manner.

Referencing the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, example embodiments of the present patent application are hereafter described. Like numbers refer to like elements throughout. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

FIG. **1** illustrates an example view of Global Positioning System (GPS), usable by navigation devices, including the navigation device of embodiments of the present application. Such systems are known and are used for a variety of purposes. In general, GPS is a satellite-radio based navigation system capable of determining continuous position, velocity, time, and in some instances direction information for an unlimited number of users.

Formerly known as NAVSTAR, the GPS incorporates a plurality of satellites which work with the earth in extremely precise orbits. Based on these precise orbits, GPS satellites can relay their location to any number of receiving units.

The GPS system is implemented when a device, specially equipped to receive GPS data, begins scanning radio frequencies for GPS satellite signals. Upon receiving a radio signal from a GPS satellite, the device determines the precise location of that satellite via one of a plurality of different conventional methods. The device will continue scanning, in most instances, for signals until it has acquired at least three different satellite signals (noting that position is not normally, but can be determined, with only two signals using other triangulation techniques). Implementing geometric triangulation, the receiver utilizes the three known positions to determine its own two-dimensional position relative to the satellites. This can be done in a known manner. Additionally, acquiring a fourth satellite signal will allow the receiving device to calculate its three dimensional position by the same geometrical calculation in a known manner. The position and velocity data can be updated in real time on a continuous basis by an unlimited number of users.

As shown in FIG. **1**, the GPS system is denoted generally by reference numeral **100**. A plurality of satellites **120** are in orbit about the earth **124**. The orbit of each satellite **120** is not necessarily synchronous with the orbits of other satellites **120** and, in fact, is likely asynchronous. A GPS receiver **140**, usable in embodiments of navigation devices of the present application, is shown receiving spread spectrum GPS satellite signals **160** from the various satellites **120**.

The spread spectrum signals **160**, continuously transmitted from each satellite **120**, utilize a highly accurate frequency standard accomplished with an extremely accurate atomic clock. Each satellite **120**, as part of its data signal transmission **160**, transmits a data stream indicative of that particular satellite **120**. It is appreciated by those skilled in the relevant art that the GPS receiver device **140** generally acquires spread spectrum GPS satellite signals **160** from at least three satellites **120** for the GPS receiver device **140** to calculate its two-dimensional position by triangulation. Acquisition of an additional signal, resulting in signals **160** from a total of four satellites **120**, permits the GPS receiver device **140** to calculate its three-dimensional position in a known manner.

FIG. **2** illustrates an example block diagram of electronic components of a navigation device **200** of an embodiment of the present application, in block component format. It should be noted that the block diagram of the navigation device **200** is not inclusive of all components of the navigation device, but is only representative of many example components.

The navigation device **200** is located within a housing (not shown). The housing includes a processor **210** connected to an input device **220** and a display screen **240**. The input device **220** can include a keyboard device, voice input device, touch panel and/or any other known input device utilized to input information; and the display device **240** can include any type of display screen such as an LCD display, for example. In at least one embodiment of the present application, the input device **220** and display device **240** are integrated into an integrated input and display device, including a touchpad or touchscreen input wherein a user need only touch a portion of the display device **240** to select one of a plurality of display choices or to activate one of a plurality of virtual buttons.

In addition, other types of output devices **260** can also include, including but not limited to, an audible output device. As output device **260** can produce audible information to a user of the navigation device **200**, it is equally understood that input device **240** can also include a microphone and software for receiving input voice commands as well.

In the navigation device **200**, processor **210** is operatively connected to and set to receive input information from input device **240** via a connection, and operatively connected to at least one of display device **240** and output device **260**, via connections to output information thereto. Further, the processor **210** is operatively connected to memory **230** via a connection and is further adapted to receive/send information from/to input/output (I/O) ports **270** via a connection, wherein the I/O port **270** is connectable to an I/O device **280** external to the navigation device **200**. The external I/O device **270** may include, but is not limited to an external listening device such as an earpiece for example. The connection to I/O device **280** can further be a wired or wireless connection to any other external device such as a car stereo unit for hands-free operation and/or for voice activated operation for example, for connection to an ear piece or head phones, and/or for connection to a mobile phone for example, wherein the mobile phone connection may be used to establish a data connection between the navigation device **200** and the internet or any other network for example, and/or to establish a connection to a server via the internet or some other network for example.

In at least one embodiment, the navigation device **200** includes an internal modem **290**, connected to processor **210** and memory **230**, for establishing data connections as will be described hereafter. The modem **290** may further be connected to transceiver **300** for transmitting information to and receiving information from server **302**. The transceiver **300** is further connected to processor **210**.

The navigation device **200**, in at least one embodiment, may establish a "mobile" network connection with the server **302** via an external mobile device not shown (such as a mobile phone, PDA, and/or any device with mobile phone technology) establishing a digital connection (such as a digital connection via known Bluetooth technology for example). Thereafter, through its network service provider, the mobile device can establish a network connection (through the internet for example) with a server **302**. As such, a "mobile" network connection may be established between the navigation device **200** (which can be, and often times is mobile as it travels alone and/or in a vehicle) and the server **302** to provide a "real-time" or at least very "up to date" gateway for information.

The establishing of the network connection between the mobile device (via a service provider) and another device such as the server **302**, using the internet for example, can be done in a known manner. This can include use of TCP/IP

layered protocol for example. The mobile device can utilize any number of communication standards such as CDMA, GSM, WAN, etc.

As such, an internet connection may be utilized which is achieved via data connection, via a mobile phone or mobile phone technology within the navigation device **200** for example. For this connection, an internet connection between the server **302** and the navigation device **200** is established. This can be done, for example, through a mobile phone or other mobile device and a GPRS (General Packet Radio Service)-connection (GPRS connection is a high-speed data connection for mobile devices provided by telecom operators; GPRS is a method to connect to the internet.

The navigation device **200** can further complete a data connection with the mobile device, and eventually with the internet and server **302**, via existing Bluetooth technology for example, in a known manner, wherein the data protocol can utilize any number of standards, such as the GSRM, the Data Protocol Standard for the GSM standard, for example.

For GRPS phone settings, the Bluetooth enabled device may be used to correctly work with the ever changing spectrum of mobile phone models, manufacturers, etc., model/manufacturer specific settings may be stored on the navigation device **200** for example. The data stored for this information can be updated in a manner discussed in any of the embodiments, previous and subsequent.

The navigation device **200** may include its own mobile phone technology within the navigation device **200** itself (including an antenna for example, wherein the internal antenna of the navigation device **200** can further alternatively be used). The mobile phone technology within the navigation device **200** can include internal components as specified above, and/or can include an insertable SIM (subscriber identity module) card, complete with necessary mobile phone technology and/or an antenna for example. As such, mobile phone technology within the navigation device **200**, in conjunction with modem **290**, can similarly establish a network connection between the navigation device **200** and the server **302**, via the internet for example, in a manner similar to that of any mobile device. It should be noted that such a modem **290** can be internal to the navigation device **200**, or external thereto, such as in an adapter, for example see U.S. application serial number 11/907,254 entitled "Enhanced Cigarette Lighter Adapter" and filed Oct. 10, 2007, the entire contents of which are hereby incorporated herein by reference. If located in the adapter, upon the adapter being plugged in to a vehicle for example, power can be supplied to the navigation device **200**. In addition, the modem can then be triggered to establish a network connection with the server **200** to send information thereto and receive information therefrom.

FIG. **2** further illustrates an operative connection between the processor **210** and an antenna/receiver **250**, wherein the antenna/receiver **250** can be a GPS antenna/receiver for example. It will be understood that the antenna and receiver designated by reference numeral **250** are combined schematically for illustration, but that the antenna and receiver may be separately located components, and that the antenna may be a GPS patch antenna or helical antenna for example.

Further, it will be understood by one of ordinary skill in the art that the electronic components shown in FIG. **2** are powered by power sources (not shown) in a conventional manner. As will be understood by one of ordinary skill in the art, different configurations of the components shown in FIG. **2** are considered within the scope of the present application. For example, in one embodiment, the components shown in FIG. **2** may be in communication with one another via wired and/or wireless connections and the like. Thus, the scope of the navigation device **200** of the present application includes a portable or handheld navigation device **200**.

FIG. **3** illustrates an example block diagram of a server **302** and a navigation device **200** of the present application, via a generic communications channel **318**, of an embodiment of the present application. The server **302** and a navigation device **200** of the present application can communicate when a connection via communications channel **318** is established between the server **302** and the navigation device **200** (noting that such a connection can be a data connection via mobile device, a direct connection via personal computer via the internet, a data connection via modem **290**, etc.).

The server **302** includes, in addition to other components which may not be illustrated, a processor **304** operatively connected to a memory **306** and further operatively connected, via a wired or wireless connection **314**, to a mass data storage device **312**. The processor **304** is further operatively connected to transmitter **308** and receiver **310**, to transmit and send information to and from navigation device **200** via communications channel **318**. The signals sent and received may include data, communication, and/or other propagated signals. Information received by server **302** can include but is not limited to received information relating to changes in position and speed of a vehicle housing a navigation device **200**; and information sent by the server **302** can include but is not limited to calculated traffic information and/or other information relating to potential delays along a route of travel of a vehicle in which a navigation device **200** is located. The transmitter **308** and receiver **310** may be selected or designed according to the communications requirement and communication technology used in the communication design for the navigation system **200**. Further, it should be noted that the functions of transmitter **308** and receiver **310** may be combined into a signal transceiver **309**.

Server **302** is further connected to (or includes) a mass storage device **312**, noting that the mass storage device **312** may be coupled to the server **302** via communication link **314**. The mass storage device **312** contains a store of navigation data and map information, and can again be a separate device from the server **302** or can be incorporated into the server **302**.

The navigation device **200** is adapted to communicate with the server **302** through any communications channel generally designated by **318**, and includes processor, memory, etc. as previously described with regard to FIG. **2**, as well as transmitter **320** and receiver **322** to send and receive signals and/or data through the communications channel **318**, noting that these devices can further be used to communicate with devices other than server **302**. Further, the transmitter **320** and receiver **322** are selected or designed according to communication requirements and communication technology used in the communication design for the navigation device **200** and the functions of the transmitter **320** and receiver **322** may be combined into a single transceiver **300**.

Software stored in server memory **306** provides instructions for the processor **304** and allows the server **302** to provide services to the navigation device **200**, such as calculation and transmission of traffic information and/or other information relating to potential delays along a route of travel of a vehicle in which a navigation device **200** is located. One service provided by the server **302** involves processing requests from the navigation device **200** and transmitting navigation data from the mass data storage **312** to the navigation device **200**. According to at least one embodiment of the present application, another service provided by the server **302** includes processing the navigation data using various algorithms for a desired application (such as calculation

of traffic information and/or other information relating to potential delays along a route of travel of a vehicle in which a navigation device **200** is located for example) and sending the results of these calculations to the navigation device **200**.

The communication channel **318** generically represents the propagating medium or path that connects the navigation device **200** and the server **302**. According to at least one embodiment of the present application, both the server **302** and navigation device **200** include a transmitter for transmitting data through the communication channel and a receiver for receiving data that has been transmitted through the communication channel.

The communication channel **318** is not limited to a particular communication technology. Additionally, the communication channel **318** is not limited to a single communication technology; that is, the channel **318** may include several communication links that use a variety of technology. For example, according to at least one embodiment, the communication channel **318** can be adapted to provide a path for electrical, optical, and/or electromagnetic communications, etc. As such, the communication channel **318** includes, but is not limited to, one or a combination of the following: electric circuits, electrical conductors such as wires and coaxial cables, fiber optic cables, converters, radio-frequency (rf) waves, the atmosphere, empty space, etc. Furthermore, according to at least one various embodiment, the communication channel **318** can include intermediate devices such as routers, repeaters, buffers, transmitters, and receivers, for example.

In at least one embodiment of the present application, for example, the communication channel **318** includes telephone and computer networks. Furthermore, in at least one embodiment, the communication channel **318** may be capable of accommodating wireless communication such as radio frequency, microwave frequency, infrared communication, etc. Additionally, according to at least one embodiment, the communication channel **318** can accommodate satellite communication. Additionally, according to at least one embodiment, the communication channel **318** can accommodate multiple, independent satellite systems, and GPS receivers capable of multiple frequencies and signal acquisitions. (Covers impending addition of Multiple Satellite Systems, including, but no limited to; GLONASS, GPS 2, GPS 2.5-3, Galileo and ChinaSat).

The communication signals transmitted through the communication channel **318** include, but are not limited to, signals as may be required or desired for given communication technology. For example, the signals may be adapted to be used in cellular communication technology such as Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), Global System for Mobile Communications (GSM), etc. Both digital and analogue signals can be transmitted through the communication channel **318**. According to at least one embodiment, these signals may be modulated, encrypted and/or compressed signals as may be desirable for the communication technology.

The mass data storage **312** includes sufficient memory for the desired navigation applications. Examples of the mass data storage **312** may include magnetic data storage media such as hard drives for example, optical storage media such as CD-Roms for example, charged data storage media such as flash memory for example, molecular memory, etc.

According to at least one embodiment of the present application, the server **302** includes a remote server accessible by the navigation device **200** via a wireless channel. According to at least one other embodiment of the application, the server **302** may include a network server located on a local area network (LAN), wide area network (WAN), virtual private network (VPN), etc.

According to at least one embodiment of the present application, the server **302** may include a personal computer such as a desktop or laptop computer, and the communication channel **318** may be a cable connected between the personal computer and the navigation device **200**. Alternatively, a personal computer may be connected between the navigation device **200** and the server **302** to establish an internet connection between the server **302** and the navigation device **200**. Alternatively, a mobile telephone or other handheld device (and/or a modem such as modem **290**) may establish a wireless connection to the internet, for connecting the navigation device **200** to the server **302** via the internet.

The navigation device **200** may be provided with information from the server **302** via information downloads which may be periodically updated upon a user connecting navigation device **200** to the server **302** and/or may be more dynamic upon a more constant or frequent connection being made between the server **302** and navigation device **200** via a wireless mobile connection device and TCP/IP connection for example. For many dynamic calculations, the processor **304** in the server **302** may be used to handle the bulk of the processing needs, however, processor **210** of navigation device **200** can also handle much processing and calculation, oftentimes independent of a connection to a server **302**.

The mass storage device **312** connected to the server **302** can include volumes more cartographic and route data than that which is able to be maintained on the navigation device **200** itself, including maps, etc. The server **302** may process, for example, the majority of the devices of a navigation device **200** which travel along the route using a set of processing algorithms. Further, the cartographic and route data stored in memory **312** can operate on signals (e.g. GPS signals), originally received by the navigation device **200**.

As indicated above in FIG. **2** of the application, a navigation device **200** of an embodiment of the present application includes a processor **210**, an input device **220**, and a display screen **240**. In at least one embodiment, the input device **220** and display screen **240** are integrated into an integrated input and display device to enable both input of information (via direct input, menu selection, etc.) and display of information through a touch panel screen, for example. Such a screen may be a touch input LCD screen, for example, as is well known to those of ordinary skill in the art. Further, the navigation device **200** can also include any additional input device **220** and/or any additional output device **240**, such as audio input/output devices for example.

FIGS. **4**A and **4**B are perspective views of an actual implementation of an embodiment of the navigation device **200**. As shown in FIG. **4**A, the navigation device **200** may be a unit that includes an integrated input and display device **290** (a touch panel screen for example) and the other components of FIG. **2** (including but not limited to internal GPS receiver **250**, microprocessor **210**, a power supply, memory systems **220**, etc.).

The navigation device **200** may sit on an arm **292**, which itself may be secured to a vehicle dashboard/window/etc. using a large suction cup **294**. This arm **292** is one non-limiting example of a docking station to which the navigation device **200** can be docked.

As shown in FIG. **4**B, the navigation device **200** can be docked or otherwise connected to an arm **292** of the docking station by snap connecting the navigation device **292** to the arm **292** for example (this is only one example, as other known alternatives for connection to a docking station are

within the scope of the present application). The navigation device **200** may then be rotatable on the arm **292**, as shown by the arrow of FIG. **4**B. To release the connection between the navigation device **200** and the docking station, a button on the navigation device **200** may be pressed, for example (this is only one example, as other known alternatives for disconnection to a docking station are within the scope of the present application).

The navigation device **200**, in at least one embodiment, may establish a "mobile" network connection with the server **302** via a mobile device **400** (such as a mobile phone, PDA, and/or any device with mobile phone technology) establishing a digital connection (such as a digital connection via known Bluetooth technology for example). Thereafter, through its network service provider, the mobile device **400** can establish a network connection (through the internet for example) with a server **302**. As such, a "mobile" network connection is established between the navigation device **200** (which can be, and often times is mobile as it travels alone and/or in a vehicle) and the server **302** to provide a "real-time" or at least very "up to date" gateway for information.

The establishing of the network connection between the mobile device **400** (via a service provider) and another device such as the server **302**, using the internet **410** for example, can be done in a known manner. This can include use of TCP/IP layered protocol for example. The mobile device **400** can utilize any number of communication standards such as CDMA, GSM, WAN, etc.

As such, an internet connection may be utilized which is achieved via data connection, via a mobile phone or mobile phone technology within the navigation device **200** for example. For this connection, an internet connection between the server **302** and the navigation device **200** is established. This can be done, for example, through a mobile phone or other mobile device and a GPRS (General Packet Radio Service)-connection (GPRS connection is a high-speed data connection for mobile devices provided by telecom operators; GPRS is a method to connect to the internet).

The navigation device **200** can further complete a data connection with the mobile device **400**, and eventually with the internet **410** and server **302**, via existing Bluetooth technology for example, in a known manner, wherein the data protocol can utilize any number of standards, such as the GSRM, the Data Protocol Standard for the GSM standard, for example.

The navigation device **200** may include its own mobile phone technology within the navigation device **200** itself (including an antenna for example, wherein the internal antenna of the navigation device **200** can further alternatively be used). The mobile phone technology within the navigation device **200** can include internal components as specified above, and/or can include an insertable SIM card and modem **290**, complete with necessary mobile phone technology and/or an antenna for example. As such, mobile phone technology within the navigation device **200** can similarly establish a network connection between the navigation device **200** and the server **302**, via the internet **410** for example, in a manner similar to that of any mobile device **400**.

For GRPS phone settings, the Bluetooth enabled device may be used to correctly work with the ever changing spectrum of mobile phone models, manufacturers, etc., model/manufacturer specific settings may be stored on the navigation device **200** for example. The data stored for this information can be updated in a manner discussed in any of the embodiments, previous and subsequent.

In an embodiment of the present application, a method includes determining a route of travel of a vehicle in which the navigation device **200** is located, based upon at least a desired destination and a current location of the vehicle; storing map information including attribute information relating to network area coverage; and determining, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel.

In an embodiment of the present application, a navigation device **200** includes a processor **210** to determine a route of travel of a vehicle in which the navigation device **200** is located, based upon at least a desired destination and a current location of the vehicle; and a memory **230** to store map information including attribute information relating to network area coverage, the processor **210** being further useable to determine, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel.

In an embodiment of the present application, mobile phone technology of the navigation device **200** itself can include a modem **290**, either located internal to the navigation device **200** or external thereto, such as in an adapter for example. Throughout the application, the "internal" or navigation device modem **290** may be one within the navigation device **200** and/or within an adapter of the navigation device **200**, such as an "in car" power adapter (for example, see U.S. application Ser. No. 11/907,254, the entire contents of which are incorporated herein by reference). Further, a SIM card (enabled for GPRS data traffic for example) can be included in the navigation device **200** to allow the modem **290** to connect to the server **302**.

When modem **290** is located internal to navigation device **200**, Network Data Traffic between navigation device **200** and server **302** may be recorded by the enabling Mobile Network Operator (MNO). In this embodiment the navigation device manufacturer (for example TomTom) may act as a Virtual Mobile Network Operator (VMNO), and the individual user of the navigation device may pay for services based on unlimited service within the package of the navigation device manufacturer for example.

For example, if a user subscribes to a National package, data traffic may be obtained on an unlimited use basis (to a pre-defined maximum for example) for data services between the server **302** and the navigation device **200**, using modem **290** and a SIM card registered to their account. As such, a connection between the navigation device **200** and the server **302** can be established any time after powering on of the navigation device **200**, for example.

When modem **290** is located external to navigation device **200** (such as when the modem in a paired device, such as a mobile phone for example, is being used), Network Data Traffic between navigation device **200** and server **302** may be recorded by the Mobile Network operator of the mobile device paired with the navigation device **200**, and uses a SIM card and account, not controlled by the navigation device manufacturer (TomTom for example). In this embodiment, there would be no billing or usage agreement arrangement between the navigation device manufacturer (TomTom) and the Mobile Network Operator (MNO).

Once the navigation device **200** is purchased and turned on, a data (e.g. internet) connection between the modem **290** and server **302** may be established to permit receipt of service (traffic, traffic speed camera information, etc.), map, LTO, etc. information such as, for example, information relating to potential delays along a route of travel of a vehicle housing the navigation device **200** (such as traffic information for

example) from the server **302**. However, although such a data connection may be established, such a connection with the server **302** may not always be maintained, depending upon network area coverage of the network on which the connection is established.

The receipt of any information by the navigation device **200** can only occur as long as the connection is maintained. Although connection via modem **290**, in conjunction with a SIM card and transceiver **300**, is better than a Bluetooth connection in that potential unpredictable charges, such as "roaming" charges on a mobile network for example, can be avoided, such a wireless connection, like any other wireless connection, is subject to areas of drops or weak signal strength areas, or areas of network change, which will cause the modem connection to be lost and/or deteriorated to the point where data information transfer with the server **302** will fail.

The inventors discovered that to the extent that such areas can be detected or predicted in advance, at least one embodiment of the present application provides a method for determining, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel. Thereafter, the method of an embodiment of the present application includes transferring information between the navigation device **200** and a server **302** upon determining that network area coverage will permit data information transfer.

Accordingly, FIG. **6** is a flowchart illustrating an embodiment of the present application. In S**600**, a route of travel of a vehicle in which the navigation device **200** is located, based upon at least a desired destination and a current location of the vehicle, is determined by processor **210**. In S**610**, either before or after determining the route of travel in S**600**, map information is stored in memory **230** for example, including attribute information relating to network area coverage. Thereafter, in S**620**, based upon at least one of the stored map information and the attribute information and based upon the route of travel of the vehicle, the processor **210** determines when network area coverage will permit data information transfer along the route of travel.

In one embodiment, Network Coverage (for network carriers) and use type information may be stored as a Map Vendor Map Attribute. These attributes may be similar to current Navigation Map Attributes, and may be stored as geographically related zone data for example, as part of a Map Data (Attribute) Database. This data can be Map Vendor Supplied (Tele Atlas, NAVTEQ, etc.), 3rd party Supplied (POI, Map Data Vendors), or Manufacture Supplied (TomTom, Garmin, etc.).

As in Current Implementations, Map Vendor Supplied Data may be included in a release mechanism already in place, and may follow the quarterly release cycles currently followed by all major Navigation Quality Map Vendors, for example. In a standard manner, this data may be augmented and adjusted for a specific device, and/or manufacturer, based upon the aforementioned attributes. Further, as in current implementations, such 3rd Party and Manufacturer Supplied Data may be added after Map Vendors Publish the Quarterly Release Cycled Navigation Map Products. This data may be first accumulated, then collated, and transferred in Map attribute format, and then combined with the Navigation Map Data, to form a complete Data set and then augmented and adjusted to specific navigation device and/or manufacture stage.

In this implementation of an embodiment, both scenarios allow for quarterly updates, and allow for the navigation device user to update their map data to include the aforementioned attributes by using current methods of Over the Air updates, and/or updates when the device is docked to a home computer via the home dock.

By the processor **210** determining, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel, a modem **290** within the navigation device **200** (or external thereto in an adaptor of the navigation device **200** for example) or a Bluetooth connection paired with the mobile device, and a transceiver **300** of the navigation device **200**, allow information to be received from or transmitted to the server **302** in an uninterrupted manner. In an embodiment, the navigation device **200** may attempt to establish a GPRS connection, for example, using the modem **290** as soon as the navigation device **200** is switched on and/or connected to a power supply through an adaptor.

FIG. **7** provides an example illustration of an example Network Division Multiple Access (NDMA) model of an example embodiment of the present application. The line running through the figure and labeled **700** represents a planned route of travel planned by navigation device **200** based upon at least an input or selected desired user destination. The various dots along the route of travel **700**, labeled **1010-1080**, represent navigation user location nodes of actual locations along the route. FIG. **7** further illustrates boundaries of an example first Terrestrial Data Network Coverage Zone **710** and a second Terrestrial Data Network Coverage Zone **720**. The boxes **715** and **725** represent single terrestrial data coverage zones, and the L-shaped areas **730** and **740** respectively adjacent to boxes **715** and **725** represent zones of no terrestrial data coverage. The outer rectangle **750** represents an example of map vendor terrestrial data coverage, map attribute data (map tiles). The inner rectangle **750** represents an area where the processor **210** conducts active data coverage calculations (NDMA) to determine, based upon at least one of the map information and the attribute information and based upon the route of travel **700** of the vehicle in which the navigation device **200** is located, when network area coverage will permit data information transfer along the route of the vehicle.

For example, at point **1010**, the processor **210** may determine that the navigation device is outside the terrestrial data network coverage zone of the modem **290** for example. Thereafter, it may determine that at point **1020**, the navigation device is approaching the terrestrial data network coverage zone of the modem **290** for example. Next, at point **1030**, the processor **210** may determine that the navigation device is within the first Terrestrial Data Network Coverage Zone **710** (corresponding to the network coverage area of the modem **290** for example). As such, the processor **210** may establish a connection to a server **302** via modem **290** for example, and may download and/or upload information via transceiver **300**.

Thereafter, at node **1040**, the processor **210** may determine that the navigation device **200** is approaching the second Terrestrial Data Network Coverage Zone **720** (corresponding to the network coverage area of the modem of the mobile device paired to the navigation device **200** for example), and may start a sequence which will shut down modem **290** and which will initiate modem connection via the modem of the mobile device paired to the navigation device **200** for example. At node **1050**, a data management sequence may allow the processor **210** to determine any data activity. There-

after, at node **1060**, the handover to the second modem and to the second Terrestrial Data Network Coverage Zone **720** may be complete.

Finally, FIG. **7** further shows node **1070**, wherein the processor **210** may determine that the navigation device **200** is approaching a map vendor tile boarder and can begin initiating a switch to another map vendor. Node **1080** may then represent entry into a next map vendor map tile coverage zone.

In an embodiment, Network connection between the navigation device **200** and the server **302** can be provided via the SIM card, inserted into the navigation device **200** to establish network addresses for network connection of the modem **290** for example. In an embodiment of the present application, mobile phone technology of the navigation device **200** itself can include a modem **290**, either located internal to the navigation device **200** or external thereto, such as in an adapter for example. Further, a SIM card (enabled for GPRS data traffic for example) can be included in the navigation device **200** to allow the modem **290** to connect to the server **302**.

When modem **290** is located internal to navigation device **200**, Network Data Traffic between navigation device **200** and server **302** may be recorded by the enabling Mobile Network Operator (MNO). For Internal use, the navigation device **200** user may be required to use a specific SIM card provided by the navigation device manufacture. This SIM card may use ANTI-THEFT technology to ensure, for example, that users can only use SIM cards provided by the Manufacture in the navigation device **200**, and that users cannot use the Provided SIM Card in other, GPRS enabled devices. In both scenarios, only a combination of Manufacture provided navigation devices and Manufacture provided SIM cards can be combined to form a Communication Channel connection via modem **290**, though a pre-defined IP channel, to server **302**.

In this embodiment the navigation device manufacturer (TomTom for example) may act as a Virtual Mobile Network Operator (VMNO), and the individual users of the navigation devices may receive a branded TomTom SIM card containing additional code, and an ANTI-THEFT First Time Use Start-up sequence. Further, this SIM card may contain a list of allowed or permitted Mobile Network Operators, MNO's, and their priority sequences. Such priority sequences may determine preferred network usage and the default network selection.

Also included in this SIM card, in at least one embodiment, may be a separate list containing detailed, Manufacturer provided, priority sequencing for internal (either within the navigation device **200** or in an adapter of the navigation device **200** for example) to external modem usage (external referring to a mobile device paired to the navigation device **200** for example). This list could then be the default reference list governing rules associated with internal to external modem switching.

When modem **290** is located external to navigation device **200**, Network Data Traffic between navigation device **200** and server **302** may be a function of the Mobile Network Operator (MNO) of the user's paired mobile device, and may use a SIM card and account not controlled by the navigation device manufacturer (TomTom for example). In this embodiment, there may be a determination of network or modem prioritization between the navigation device manufacturer (TomTom for example) and the Mobile Network Operator (MNO).

Such a SIM card and modem **290** are shown in FIG. **5**, within the navigation device **200**. The SIM card can be provided to the user in exchange for a flat fee paid to the manufacturer of the navigation device **200** for subscribing to a traffic service for example (for example, a navigation device manufacturer TomTom may have an arrangement with a network service provider such as Vodophone for example, to permit TomTom to offer owners of navigation devices **200** a fixed price connection service via the internal modem **290** connection). In this arrangement, navigation device manufacturers such as TomTom can take advantage of Scales-of-Economy, simply having larger purchase power than an individual, and can affect Cost Optimization Network System Constraints.

In an embodiment, the navigation device **200** further includes an additional modem to connect the navigation device **200** to a server **302** upon the processor **210** determining via the SIM card contained internal to the navigation device **200**, available through a paired mobile device via a Bluetooth connection for example. Both modems may be terrestrial Networked data transfer specific technology, such as GSM or CDMA, the predominant Terrestrial data technologies. The internal modem **290** may be, for example, a GSM/GPRS based Modem, allowing access to specific bands of Terrestrial Data Transfer Networks. The navigation device manufacturer may provide a determination for signal frequencies based on geographic location and other commercial, and non-commercial criteria. Further, the internal modem **290** may be, for example, a CDMA/1X based Modem, allowing access to specific bands of Terrestrial Data Transfer Networks. The navigation device manufacturer may provide a determination for signal frequencies based on geographic location and other commercial, and non-commercial criteria.

With access to multiple modem connections, both internal and external to the navigation device **200**, the navigation device **200** can allow multiple access to a greater choice of specific bands of Terrestrial Data Transfer Networks. The navigation device manufacturer may provide an internal default modem **290**, and may permit access to external determination for signal frequencies based on geographic location and other commercial and/or non-commercial criteria, as well as priority sequencing for internal to external modem usage. Further, the processor **210** may be used to determine, via the SIM card contained internal to the navigation device **200** for example, a list containing detailed, Manufacturer provided, priority sequencing for internal to external modem usage. This list may contain default reference rules governing the internal to external modem switching.

Further, the transceiver **300** of the navigation device **200** to transfer information between the navigation device **200** and the server **302** upon determining that network area coverage of the default modem, the internal modem **290**, will permit data information transfer.

Still further, in at least one embodiment, an internal calculation of the processor **210** may determine that a network change is about to occur, that network coverage is/about to fall below a pre-set signal level, or that an imminent end to internal network service is to occur. Thereafter, the processor **210** will direct a switch to be performed between the internal modem **290**, default, network connection, and an external modem, secondary, network connection (via a paired mobile device for example). Data transfer information between the navigation device **200** and the server **302** via the internal modem **290** is severed through a shut down sequence during this process, and a new connection is thereafter initiated via an external modem and data communication via wither wireless protocols, such as Bluetooth, or though a direct connection, such as a secondary adaptor, for example.

In at least one embodiment, information is transmitted from between the navigation device **200** and the server **302** in

an initial start-up sequence via a default of the internal modem **290**, and thus the internal modem Network type and coverage. When the internal modem **290** does not provide coverage, or when upcoming network change is about to occur upon a planned route as determined by processor **210**, the navigation device **200** will switch the default modem to the external modem of a device paired with the navigation device **200**, for example.

In at least one embodiment, when the information transmitted is used in normal operations of the navigation device **200**, further rules may be assessed to limit, or restrict certain activities between the server **302** and the navigation device **200**. For example, when using the external modem of a paired mobile device for example, such a use might gain additional network coverage, but the cost structures are likely higher for data transfer. As such a user may wish to not download, or transfer higher data elements such as map updates, or location history files. Further, the identity of the navigation device **200**, and the intended vehicle usage and user type, could determine the associated QOS settings, thus relating these activities to the quality/cost calculation, specifically [Data Access/Network data costs]. The QOS then by category may determine mathematical activity sequence and availability.

When a modem **290** is located internal to navigation device **200**, Network Data Traffic between navigation device **200** and server **302** is recorded by the enabling Mobile Network Operator (MNO). For Internal use, the Navigation Device **200** user may use a specific SIM card provided by the device manufacture for example. This SIM card may use ANTI-THEFT technology to ensure that users can only use SIM cards provided by the Manufacture in the navigation device **200**, and that users cannot use the Provided SIM Card in other, GPRS enabled devices. In both scenarios, only a combination of Manufacture provide the navigation device **200**, and Manufacture provided SIM cards can be combined to form a Communication Channel connection via modem **290**, though a pre-defined IP channel, to server **290**.

In this embodiment, the navigation device manufacturer (TomTom for example) may act as a Virtual Mobile Network Operator (VMNO), and the individual users may receive a branded TomTom SIM card containing additional code, and an ANTI-THEFT First Time Use Start-up sequence. Further, This SIM card may contain a list of allowed Mobile Network Operators (MNO's), and their priority sequences. This sequence may determine the preferred network usage, and the default network selection.

Also included in this SIM card, may be the potential for a separate list containing detailed, Manufacturer provided, priority sequencing for internal to external modem usage. This list could then be a default reference list governing rules associated with internal to external modem switching.

Thus, in at least one embodiment, the navigation device **200** includes a modem **290** to connect the navigation device **200** to a server **302**, via the SIM card contained internal to the navigation device **200**, and via a terrestrial Networked data transfer specific technology. In at least one embodiment, the internal modem **290** is a GSM/GPRS based Modem, allowing access to specific bands of Terrestrial Data Transfer Networks. In at least one other embodiment, the internal modem **290** is a CDMA/1X based Modem, allowing access to specific bands of Terrestrial Data Transfer Networks. In either embodiment, the navigation device Manufacturer may provide determination for signal frequencies based on geographic location and other commercial and/or non-commercial criteria.

When modem **290** is located external to navigation device **200** (such as in a separate mobile device paired with the navigation device **200** via a Bluetooth connection for example), Network Data Traffic between navigation device **200** and server **302** may be a function of the user's or client's Mobile Network Operator (MNO), and may use a SIM card for an account not controlled by the navigation device manufacturer. In this embodiment, there may be a pre-determination of network, or modem, a type of prioritization between the navigation device manufacturer and the Mobile Network Operator (MNO).

Regarding the internal to external modem switching, the processor **210** may determine, via the SIM card contained internal to the navigation device **200**, a list containing detailed, Manufacturer provided for example, priority sequencing for internal to external modem **290** usage. This list may contain default reference rules governing the internal to external modem switching.

In at least one embodiment, upon an internal calculation of the processor **210** determining that a network change is about to occur, for example that network coverage is/or is about to fall below a pre-set signal level and/or that an imminent end to internal network service is about to occur, a switch may be performed between the internal, default, network connection, and an external, secondary, network connection (such as via a mobile phone/Bluetooth connection for example). Data transfer information between the navigation device **200** and a server **302**, via the internal modem **290** may be severed through a shut down sequence for example, and a new connection may be initiated via a modem connected to an adaptor of the navigation device for example, and/or data communication via wither wireless protocols, such as Bluetooth, or though a direct connection, such as via a modem in a secondary Adaptor for example. In such an embodiment, the modem **290** can operate in cooperation with a transceiver **300** to transfer information between the navigation device **200** and a server **302** upon the processor **210** determining that network area coverage of the external modem (such as via a mobile phone/Bluetooth connection for example), will permit data information transfer.

In such an embodiment, information transmitted between the navigation device **200** and the server **302** in the initial start-up sequence may default to the internal modem **290**, and thus, the internal modem Network type and coverage. When the internal modem **290** does not provide coverage, or when upcoming network change is about to occur upon a planned route, the navigation device **200** will then switch the default modem to the external modem.

The SIM card can be provided to the user in exchange for a flat fee paid to the maker of the navigation device **200** for subscribing to a traffic service for example (for example, a navigation device manufacturer TomTom may have an arrangement with a network service provider such as Vodophone for example, to permit TomTom to offer owners of navigation devices a fixed price connection service via the modem **290** connection). In this arrangement, Manufacturers such as TomTom may take advantage of Scales-of-Economy, simply having larger purchase power than an individual, and can affect Cost Optimization Network System Constraints. As technical Attributes of navigation device to server activity; the manufacture can reduce internal data usage, and the associated costs for such activities.

As technical attributes of navigation device **200** to server **302** activity; the navigation device manufacturer can reduce internal data usage, and the associated costs for such activities. For example, Block Size rounding, Group Data Pooling, and Sessions Terms and Conditions, can all be coded into the rules governing internal modem **290** usages. By default, if the modem **290** is internal to the navigation device **200**, the

modem **290** may always be enabled upon powering the device on to establish a network connection with the server **302** and/or if included in an adaptor of the navigation device, may be enabled to establish such a connection upon the adaptor being connected to the vehicle.

An embodiment of the application may include connecting the navigation device **200** to a server **302** upon determining that network area coverage will permit data information transfer and/or transferring information between the navigation device **200** and a server **302** upon determining that network area coverage will permit data information transfer. Further, the transferring of information may include at least one of uploading information to the server **302** and uploading information from the server **302**. The information for at least one of uploading and downloading may include, but is not limited to, traffic or any other service subscription information that a user may have signed up to receive, LTO file information to enable a faster determination of location of the navigation device **200** upon powering the device on, map information, etc.

In at least one embodiment, the information transmitted may be used in normal operations of the navigation device **200**, and/or further rules might be assessed to limit, or restrict certain activities between the server **302** and the navigation device **200**. For example, when using the external modem (of the paired mobile device for example), a use might gain additional network coverage over the internal modem **290** of the navigation device **200**, but the cost structures may be and/are likely higher for data transfer. As such, a user of the navigation device **200** may wish to not download, or transfer higher data elements such as map updates, or location history files, upon the switch occurring from the internal modem **290** to the external modem, of the paired mobile device for example. Further, the identity of the navigation device **200**, and the intended vehicle usage and user type could also be used to determine the associated QOS settings, thus relating these activities to the quality/cost calculation, specifically [Data Access/Network data costs]. The QOS then, by category, could be used by processor **210** to determine mathematical activity sequence and availability.

In at least one embodiment, satellite location may be used to further determine the information transmitted and reduce network outages along the route of travel of the vehicle. The GPS chipset calculation may enable navigation device **200** to determine planned and/or expected network availability, and thus to plan downloads based upon expected modem switching between the internal modem **290** and the external modem (of the paired navigation device **200** for example). This may be a function of the addition of Navigation Map Attributes, for example, wherein a layer of the Navigation Map data may contain information regarding Geographic availability of Allowed Terrestrial Data Networks (in at least one embodiment, Specifically Mobile Network Operators).

The processor **210** can then calculate the best modem choice along a route, and can plan a modem switch in advance, thus optimizing network data transfer, and/or end user cost/availability functions. As one non-limiting example, this can be done using a simple rules based management system, the navigation device **200** can request LTO files (for example) from server **302**, within the Network Coverage of the internal modem **290**, for a duration that extends past the internal modem coverage area. This can then allow for costs/availability optimized variation in for example: LTO File Request Frequency, LTO File length, and LTO File Geo-Coverage. Further, if a navigation device **290** user is currently in The Netherlands, and enters a route to Spain, the navigation device **200** should request a short LTO for the Netherlands region, and dependant on Network Coverage parameters, (for example cost, proximity to network changes, etc.) the navigation device **200** can request a longer file for the Spain Region. The navigation device **200** can thus manage LTO files, reduce to minimum network data costs, and optimize TtFF (time to first fix) calculations, and can travel accurately based upon the received information.

In at least one embodiment, the information may be transmitted upon determining device type of the navigation device **200**, such as a navigation device **200** for, for example, Commercial, Consumer (vehicle), Moto, and/or Pedestrian usage. Internal modem **290** coverage may extend to a known point. As part of a Map vendor navigation Map Attribute for example, a specific user of the navigation device **200** may wish to extend such functions past this point. For example, commercial users, and there owners, may wish to extend Track and Trace functionality across terrestrial data coverage areas. Further, if a user of the navigation device **200** is in multiple Network environment, there may be a QOS File setting that then sets usage standards for internal to external modem behavior based on use type category of the navigation device **200**, and data obtained from navigation device **200** may then be used to determine the modem behavior and expected Track and Trace availability, with enhanced accuracy and predictive methods due to increased signal availability.

Further, in at least one embodiment, once the Network Interface Protocol [1022] connection between the navigation device **200** and the server **302** is established, as part of the Protocol the connection is identified with a modem **290** and network transfer type for example, navigation device **200** to modem data transfer activities may be adjusted to best suit the criteria of the connection type.

In at least one embodiment of the present application, the method of at least one embodiment expressed above may be implemented as a navigation device **200**. In an embodiment of the present application, the navigation device **200** includes a processor **210** to determine a route of travel of a vehicle in which the navigation device **200** is located, based upon at least a desired destination and a current location of the vehicle; and a memory **230** to store map information including attribute information relating to network area coverage, the processor **210** being further useable to determine, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel. The navigation device **200** may further include a transceiver **300** to transfer information between the navigation device **200** and a server **302** upon determining that network area coverage will permit data information transfer.

In addition, the navigation device **200** may include a modem **290** to connect the navigation device **200** to a server **302**, upon the processor **210** determining that network area coverage will permit data information transfer. The modem **290** may be at least one of included in the navigation device **200** and included within an adapter of the navigation device **200**. Further, a Bluetooth connection can be used to connect the navigation device **200** to a server **302** upon the processor **210** determining that network area coverage will permit data information transfer.

Even further, any of the aforementioned methods may be embodied in the form of a program. The program may be stored on a computer readable media and is adapted to perform any one of the aforementioned methods when run on a computer device (a device including a processor). Thus, the storage medium or computer readable medium, is adapted to

store information and is adapted to interact with a data processing facility or computer device to perform the method of any of the above mentioned embodiments.

The storage medium may be a built-in medium installed inside a computer device main body or a removable medium arranged so that it can be separated from the computer device main body. Examples of the built-in medium include, but are not limited to, rewriteable non-volatile memories, such as ROMs and flash memories, and hard disks. Examples of the removable medium include, but are not limited to, optical storage media such as CD-ROMs and DVDs; magneto-optical storage media, such as MOs; magnetism storage media, including but not limited to floppy disks (trademark), cassette tapes, and removable hard disks; media with a built-in rewriteable non-volatile memory, including but not limited to memory cards; and media with a built-in ROM, including but not limited to ROM cassettes; etc. Furthermore, various information regarding stored images, for example, property information, may be stored in any other form, or it may be provided in other ways.

As one of ordinary skill in the art will understand upon reading the disclosure, the electronic components of the navigation device **200** and/or the components of the server **302** can be embodied as computer hardware circuitry or as a computer readable program, or as a combination of both.

The system and method of embodiments of the present application include software operative on the processor to perform at least one of the methods according to the teachings of the present application. One of ordinary skill in the art will understand, upon reading and comprehending this disclosure, the manner in which a software program can be launched from a computer readable medium in a computer based system to execute the functions found in the software program. One of ordinary skill in the art will further understand the various programming languages which may be employed to create a software program designed to implement and perform at least one of the methods of the present application.

The programs can be structured in an object-orientation using an object-oriented language including but not limited to JAVA, Smalltalk, C++, etc., and the programs can be structured in a procedural-orientation using a procedural language including but not limited to COBOL, C, etc. The software components can communicate in any number of ways that are well known to those of ordinary skill in the art, including but not limited to by application of program interfaces (API), interprocess communication techniques, including but not limited to report procedure call (RPC), common object request broker architecture (CORBA), Component Object Model (COM), Distributed Component Object Model (DCOM), Distributed System Object Model (DSOM), and Remote Method Invocation (RMI). However, as will be appreciated by one of ordinary skill in the art upon reading the present application disclosure, the teachings of the present application are not limited to a particular programming language or environment.

The above systems, devices, and methods have been described by way of example and not by way of limitation with respect to improving accuracy, processor speed, and ease of user interaction, etc. with a navigation device **200**.

Further, elements and/or features of different example embodiments may be combined with each other and/or substituted for each other within the scope of this disclosure and appended claims.

Still further, any one of the above-described and other example features of the present invention may be embodied in the form of an apparatus, method, system, computer program and computer program product. For example, of the aforementioned methods may be embodied in the form of a system or device, including, but not limited to, any of the structure for performing the methodology illustrated in the drawings.

Example embodiments being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

What is claimed is:

1. A method, comprising:

determining a route of travel of a vehicle in which a navigation device is located, based upon at least a desired destination and a current location of the vehicle;

storing map information including attribute information relating to network area coverage;

determining, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel;

and

connecting the navigation device to a server via at least one modem upon determining that network area coverage will permit data information transfer;

wherein the connecting is switchable between different moderns based upon determined network area coverage of the modem along the route of travel.

2. The method of claim **1**, further comprising:

transferring information between the navigation device and a server upon determining that network area coverage will permit data information transfer.

3. The method of claim **2**, wherein the transferring of information includes at least one of uploading information to the server and uploading information from the server.

4. The method of claim **1**, wherein connection is established between a modem, at least one of included in the navigation device and included within an adapter of the navigation device, and the server.

5. The method of claim **3**, wherein the information for at least one of uploading and downloading includes at least one of LTO information, traffic information and map information.

6. The method of claim **1**, wherein the modem is at least one of internal to the navigation device and in a device paired with the navigation device, and wherein the modem is at least one of a GSM/GPRS based Modem and a CDMA/1X based Modem.

7. The method of claim **1**, wherein the connecting of the navigation device to the server occurs via at least one of a modem internal to the navigation device, a modem in an adapter of the navigation device, and a modem in a device paired with the navigation device.

8. The method of claim **1**, wherein the connecting is switchable between at least one modem of the navigation device and at least one modem in a device paired with the navigation device, based upon determined network area coverage of at least one of the modems along the route of travel.

9. The method of claim **8**, comprising storing information relating to priority use of one modem over another.

10. The method of claim **9**, wherein the stored information includes stored rules governing the switching between the modem of the navigation device and the modem in the device paired with navigation device.

11. The method of claim **10**, further comprising:

transferring information between the navigation device and the server upon determining that network area coverage of at least one of the modems permits data information transfer.

12. The method of claim **8**, further comprising:

determining, based upon determined network area coverage of at least one of the modems along the route of travel, when at least one of,

a network change is about to occur,

network coverage is about to fall below a threshold level, and

an end to network service of the modem of the navigation device is imminent.

13. The method of claim **12**, further comprising connecting, upon making the determination, the navigation device to the server via the other one of the modems, upon making the determination.

14. The method of claim **13**, wherein the one of the modems is the modem of the navigation device and wherein the other of the modems is the modem of the device paired with the navigation device.

15. The method of claim **14**, further comprising:

transferring information between the navigation device and the server upon determining that network area coverage of at least one of the modems permits data information transfer.

16. The method of claim **15**, wherein information is transmitted between the navigation device and the server in an initial start-up sequence of the navigation device via the modem of the navigation device.

17. The method of claim **16**, wherein satellite location is used to further determine the information transmitted and reduce network outages along the route of travel of the vehicle.

18. The method of claim **8**, wherein a layer of the map information contains information regarding geographic network availability of modems.

19. The method of claim **18**, further comprising selecting along the route of travel, based upon the geographic network availability, at least one of the at least one modem of the navigation device and the at least one modem in a device paired with the navigation device, and planning a switch along the route of travel between the at least one modem of the navigation device and the at least one modem in a device paired with the navigation device.

20. The method of claim **19**, further comprising planning network downloads from or uploads to the server based upon the selecting and planning.

21. A navigation device, comprising:

means for determining a route of travel of a vehicle in which the navigation device is located, based upon at least a desired destination and a current location of the vehicle;

means for storing map information including attribute information relating to network area coverage;

means for determining, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel; and

means for connecting the navigation device a server via at least one modem upon determining that network area coverage will permit data information transfer;

wherein the means for connecting is switchable between different modems based upon determined network area coverage of the modem along the route or travel.

22. The navigation device of claim **21**, further comprising:

means for transferring information between the navigation device and a server upon determining that network area coverage will permit data information transfer.

23. The navigation device of claim **22**, wherein the transferring of information includes at least one of uploading information to the server and uploading information from the server.

24. The navigation device of claim **21**, wherein the modem is at least one of included in the navigation device and included within an adapter of the navigation device.

25. The navigation device of claim **23**, wherein the information for at least one of uploading and downloading includes at least one of LTC) information, traffic information and map information.

26. The navigation device of claim **21**, wherein the modem is at least one of internal to the navigation device and in a device paired with the navigation device, and wherein the modem is at least one of a OSM/GPRS based Modem and a CDMA/1X based Modem.

27. The navigation device of claim **21**, wherein the means for connecting includes at least one of a modem internal to the navigation device, a modem in an adapter of the navigation device, and a modem in a device paired with the navigation device.

28. The navigation device of claim **21**, wherein the means for connecting is switchable between at least one modem of the navigation device and at least one modem in a device paired with the navigation device, based upon determined network area coverage of at least one of the modems along the route of travel.

29. The navigation device of claim **28**, comprising means for storing information relating to priority use of one modem over another.

30. The navigation device of claim **29**, wherein the stored information includes stored rules governing the switching between the modem of the navigation device and the modem in the device paired with navigation device.

31. The navigation device of claim **30**, further comprising:

means for transferring information between the navigation device and the server upon determining that network area coverage of at least one of the modems permits data information transfer.

32. The navigation device of claim **28**, wherein the means for determining is further for determining, based upon determined network area coverage of at least one of the modems along the route of travel, when at least one of,

a network change is about to occur,

network coverage is about to fall below a threshold level, and

an end to network service of the modem of the navigation device is imminent.

33. The navigation device of claim **32**, wherein, upon making the determination, the means for connecting connects the navigation device to the server via the other one of the modems.

34. The navigation device of claim **33**, wherein the one of the moderns is the modem of the navigation device and wherein the other of the modems is the modem of the device paired with the navigation device.

35. The navigation device of claim **34**, further comprising:

means for transferring information between the navigation device and the server upon determining that network area coverage of at least one of the modems permits data information transfer.

36. The navigation device of claim **35**, wherein information is transmitted between the navigation device and the

server in an initial start-up sequence of the navigation device via the modem of the navigation device.

37. The navigation device of claim **36**, wherein satellite location is used to further determine the information transmitted and reduce network outages along the route of travel of the vehicle.

38. The navigation device of claim **21**, wherein a layer of the map information contains information regarding geographic network availability of modems.

39. The navigation device of claim **38**, further comprising means for selecting along the route of travel, based upon the geographic network availability, at least one of the at least one modem of the navigation device and the at least one modem in a device paired with the navigation device, and planning a switch along the route of travel between the at least one modem of the navigation device and the at least one modem in a device paired with the navigation device.

40. The navigation device of claim **39**, further comprising means for planning network downloads from or uploads to the server based upon the selecting and planning.

41. A navigation device, comprising:

a processor to determine a route of travel of a vehicle in which the navigation device is located, based upon at least a desired destination and a current location of the vehicle;

a memory to store map information including attribute information relating to network area coverage, the processor being further useable to determine, based upon at least one of the map information and the attribute information and based upon the route of travel of the vehicle, when network area coverage will permit data information transfer along the route of travel; and a modem to connect the navigation device to a, server upon the processor determining that network area coverage will permit data information transfer

wherein the connection is switchable between different modems based upon determined network area coverage of the modem along the route of travel.

42. The navigation device of claim **41**, further comprising:

a transceiver to transfer information between the navigation device and a server upon determining that network area coverage will permit data information transfer.

43. The navigation device of claim **42**, wherein the transferring of information includes at least one of uploading information to the server and uploading information from the server.

44. The navigation device of claim **41**, wherein the modem is at least one of included in the navigation device and included within an adapter of the navigation device.

45. The navigation device of claim **43**, wherein the information for at least one of uploading and downloading includes at least one of LTO information, traffic information and map information.

46. The navigation device of claim **41**, wherein the modem is at least one of internal to the navigation device and in a device paired with the navigation device, and wherein the modern is at least one of a GSM/GPRS based Modem and a CDMA/1X based Modem.

47. The navigation device of claim **41**, wherein the modem includes at least one of a modem internal to the navigation device, a modem in an adapter of the navigation device, and a modem in a device paired with the navigation device.

48. The navigation device of claim **41**, wherein the connection is switchable between at least one modem of the navigation device and at least one modem in a device paired with the navigation device, based upon determined network area coverage of at least one of the modems along the route of travel.

49. The navigation device of claim **48**, a memory to store information relating to priority use of one modem over another.

50. The navigation device of claim **49**, wherein the stored information includes stored rules governing the switching between the modem of the navigation device and the modem in the device paired with navigation device.

51. The navigation device of claim **50**, further comprising:

a transceiver to transfer information between the navigation device and the server upon the processor determining that network area coverage of at least one of the modems permits data information transfer.

52. The navigation device of claim **48**, wherein the processor is further useable to determine, based upon determined network area coverage of at least one of the modems along the route of travel, when at least one of,

a network change is about to occur,

network coverage is about to fall below a threshold level, and

an end to network service of the modem of the navigation device is imminent.

53. The navigation device of claim **52**, wherein, upon making the determination, the processor connects the navigation device to the server via the other one of the modems.

54. The navigation device of claim **53**, wherein the one of the modems is the modem of the navigation device and wherein the other of the modems is the modem of the device paired with the navigation device.

55. The navigation device of claim **54**, further comprising:

a transceiver to transfer information between the navigation device and the server upon the processor determining that network area coverage of at least one of the modems permits data information transfer.

56. The navigation device of claim **55**, wherein information is transmitted between the navigation device and the server in an, initial start-up sequence of the navigation device via the modem of the navigation device.

57. The navigation device of claim **56**, wherein satellite location is used to further determine the information transmitted and reduce network outages along the route of travel of the vehicle.

58. The navigation device of claim **41**, wherein a layer of the map information contains information regarding geographic network availability of modems.

59. The navigation device of claim **58**, wherein the processor is further useable to select along the route of travel, based upon the geographic network availability, at least one of the at least one modem of the navigation device and the at least one modem in a device paired with the navigation device, and planning a switch along the route of travel between the at least one modem of the navigation device and the at least one modem in a device paired with the navigation device.

60. The navigation device of claim **59**, wherein the processor is further useable to plan network downloads from or uploads to the server based upon the selecting and planning.

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